

Serial No. 10/648,265

Attorney Docket No. 20-016

LISTING OF CLAIMS:

1. (Currently amended) A laser diode apparatus comprising:

a substrate having first and second major surfaces;

a plurality of substantially identical, parallel grooves formed in the first major surface of the substrate, wherein

~~at least a first one of the plurality of grooves serves as a cooling channel~~

each of the grooves has a pair of opposed, parallel side walls and an opening formed in the major surface, and the sidewalls are perpendicular to the major surface and extend from the major surface to bottoms of the grooves,

the grooves include at least one heat-emitting groove and at least a pair of cooling grooves, and each of the cooling grooves is open and defines a coolant space that is adapted to accommodate cooling fluid through which coolant flows to cool the substrate;
and

~~a laser diode bar located in at least a second one of the plurality grooves, wherein the first groove is in close proximity to the second groove~~

a laser diode bar located in the heat-emitting groove, wherein

the laser diode bar has a first side, which is parallel to the side walls of the heat-emitting groove, and a second side, which is opposite to and parallel to the first side;

the heat-emitting groove is located between the cooling grooves, such that the laser diode bar is located between the coolant spaces and such that heat will be transferred in a direction parallel to the major surface from the first side of the laser diode

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bar to one of the coolant spaces and from the second side of the laser diode bar to the other of the coolant spaces.

2. (Currently amended) The laser diode apparatus according to claim 1, wherein a metallization layer is formed on ~~side walls of the second groove~~ the side walls of the heat-emitting groove.

3. (Currently amended) The laser diode apparatus according to claim 1, wherein a metallization layer is formed on ~~walls defining the first groove~~ the sidewalls of the cooling grooves.

4. (Currently amended) The laser diode apparatus according to claim 1, wherein the ~~first~~ cooling groove is one of a plurality of ~~grooves serving as cooling channels~~ cooling grooves through which coolant flows to cool the substrate, and the ~~second~~ heat-emitting groove is one of a plurality of heat-emitting grooves in which laser diode bars are respectively located.

5. (Canceled)

6. (Currently amended) The laser diode apparatus according to claim 1, wherein the laser diode apparatus ~~is surrounded by~~ includes a housing, and the housing includes a window that is opposed to an emitting face of the laser diode bar.

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7. (Currently amended) A laser diode apparatus comprising:
a substrate having first and second major surfaces;
a plurality of grooves formed in the first major surface of the substrate, wherein at least a
first one of the plurality of grooves serves as a cooling channel through which coolant flows to
cool the substrate; and
a laser diode bar located in at least a second one of the plurality grooves, wherein the first
groove is in close proximity to the second groove; wherein
the apparatus includes a housing, wherein the housing includes a window that is
opposed to an emitting face of the laser diode bar, and
~~The laser diode apparatus according to claim 6, wherein a space exists between~~
the laser diode apparatus and the housing, coolant flows through the space, and the space
communicates with the cooling channel.

8. (Original) The laser diode apparatus according to claim 7, wherein an inlet is formed in the housing to conduct coolant into the housing, and an outlet is formed in the housing for permitting coolant to exit the housing.

9. (Original) The laser diode apparatus according to claim 8, wherein the inlet is located on a first side of the housing, the outlet is located on a second side of the housing, which is opposite to the first side of the housing, and the substrate is arranged in the housing such that the grooves extend from the first side of the housing to the second side of the housing and such that the cooling channel is aligned with the direction of coolant flow.

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10-16 (Canceled)

17. (Currently amended) A method of forming monolithic laser diode arrays, the method comprising:

providing a monolithic substrate;

forming a row of substantially identical, parallel grooves in a major surface of the substrate, such that grooves are spaced apart at regular intervals, wherein a set of three neighboring ones of the grooves includes a heat-emitting groove and a pair of cooling grooves
~~first groove and a second groove in the monolithic substrate such that the first groove is adjacent to and parallel to the second groove;~~

forming side walls of the first and second grooves vertically in the monolithic substrate, such that each side wall is perpendicular to the major surface and such that each groove has an opening in the major surface; and

depositing a metallization layer along at least the side walls of the first groove to form a metallized groove;

setting a plurality of laser diodes in at least the first groove
~~laser diode bar in the heat-emitting groove, such that a radiation emitting surface of each of the plurality of laser diodes the laser diode bar is parallel to the major surface of the substrate, wherein the laser diode bar has a pair of sides, which are opposite to and parallel to one another, and wherein each of the sides of the laser diode bar is perpendicular to the radiation-emitting surface, and the opposite sides of the laser diode bar contact corresponding side walls of the heat-emitting groove; and~~

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leaving the second groove vacant to the cooling grooves open to define coolant spaces that accommodate a cooling fluid serve as a cooling channel to facilitate heat transfer from the laser diodes laser diode bar, wherein the laser diode bar is located between the coolant spaces, such that heat will be transferred in a direction parallel to the first major surface from the laser diode bar to the coolant spaces and such that the coolant spaces are located in a direction that is perpendicular to the side walls of the grooves from any point on the sides of the laser diode bars.

18. (Currently amended) ~~A method~~ The method as claimed in claim 17, wherein the method includes forming a plurality of grooves that includes the first heat-emitting groove and the ~~second groove~~ cooling grooves, such that the first heat-emitting groove is one of a plurality of heat-emitting grooves that hold laser diodes, and the ~~second groove is one of~~ cooling grooves are included in a plurality of vacant grooves, wherein the vacant cooling grooves are alternated with the heat-emitting grooves that hold laser diodes.

19. (New) The laser diode apparatus according to claim 1, wherein the laser diode bars are arranged such that the entirety of each laser diode bar is located between the cooling channels and such that the distance between the laser diode bar and the nearest cooling channel is the same for any point on the laser diode bar.

20. (New) The laser diode apparatus according to claim 1, wherein the apparatus includes a housing, a space is formed between the substrate and the housing, and the space communicates with the interior of the cooling grooves, such that the cooling fluid can flow from the space to the cooling grooves.

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21. (New) The laser diode apparatus according to claim 1, wherein the cooling grooves are unobstructed such that the cooling fluid can contact the entirety of the sidewalls of the cooling grooves from the major surface to the bottoms of the cooling grooves.

22. (New) The laser diode apparatus according to claim 1, wherein the cooling grooves are located such that a line extending perpendicularly from any point on the first side or the second side of the laser diode bar will pass through the coolant space of a corresponding one of the cooling grooves.

23. (New) The laser diode apparatus according to claim 1, wherein the coolant spaces are located in a direction that is perpendicular to the sides of the laser diode bars from any point on the sides of the laser diode bars.

24. (New) The laser diode apparatus according to claim 1, wherein the coolant spaces extend in a depth direction from the major surface to at least the depth of the laser diode bar.

25. (New) The laser diode apparatus according to claim 1, wherein the grooves are spaced apart at regular intervals.

26. (New) The laser diode apparatus according to claim 1, wherein the laser diode bar is located between the coolant spaces such that each entire side of the laser diode bar faces the

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coolant space of a corresponding one of the cooling grooves, and the distance to the nearest one of the coolant spaces from any point on the first side of the laser diode is uniform, and the distance to the nearest one of the coolant spaces from any point on the second side of the laser diode is uniform.

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